

- c. What can you infer from the bits of wheat and wheat pollen present?
- d. What might the different markings on his body indicate?

Refer back to the descriptive paragraphs in Step 1 and to Figure 2.8 if you wish.

- 6. Did you use evidence or make inferences to answer the questions in Step 5? Explain.
- 7. If you could have three more pieces of evidence or three more bits of information to help you complete your work, what would you want them to be? Explain why you chose the pieces you did.

Analysis

Answer the following questions in your journal and be prepared to share your ideas in a class discussion.

- 1. What particular physical features of the Iceman would you compare with modern humans if you were looking for evidence of biological evolution? Explain.
- 2. What artifacts from the Iceman would you compare with artifacts from modern humans as evidence of cultural evolution?
- 3. Do you think there have been greater changes in humans physically or culturally in the last 5000 years? Explain your answer.

EVOLUTION IN ACTION

The attendants wheel the teenage girl into the operating room as her mother waits anxiously in the sitting room at the end of the hall. The girl's appendix is so severely inflamed that her doctor worries that it might rupture before the operation can be performed. In spite of the danger, the operation goes smoothly, and the surgeon removes the girl's inflamed appendix without mishap. After surgery, nurses take the patient to the recovery room. In about 30 minutes, she regains consciousness and asks for her mother.

All seems to be going well in the first 24 hours after surgery. However, on the following day, the girl begins to run a fever, which quickly rises. Her doctor realizes that she has contracted an internal infection from the surgery.

The girl in this story has a bacterial infection. A strain of *Staphylococcus* bacteria contaminated the open wound during surgery, and it continued to multiply inside her body. Will she survive this infection? You will use your knowledge of evolution and your scientific thinking skills to propose an explanation for what happens next. As you complete this activity, you will evaluate what you have learned about the way living organisms change across time.

Evaluate

Process and Procedures

1. Read the following three descriptions of *possible outcomes* for the opening scenario. Each description takes place in a different time period in the history of Western medicine.

Scenario 1

The year is 1925: The girl becomes delirious from fever; in a few days, she dies.

Scenario 2

The year is 1945: The girl receives an injection of the antibiotic penicillin, followed by repeated doses. Within 24 hours her fever is reduced, and in a week she is released from the hospital, well on her way to recovery.

Scenario 3

The year is 1965: The girl receives an injection of the antibiotic penicillin, followed by repeated doses. Despite this treatment, her fever continues, and she becomes delirious. In a few days, she dies.

2. For each outcome, write one paragraph that explains *why* that outcome is possible at that time in history.

Base your explanation on your experiences in this chapter. The information in Antibiotics and in Figure 2.9 on page 55 in this activity may help you decide why the outcomes are different.

Analysis

1. The example of a bacterial infection in this activity can serve as a model of evolution. In a short essay, explain how this example illustrates evolution in action in modern times. A good description of this model of evolution
 - describes the evolutionary change that occurs in this model,
 - identifies the factor in the bacteria's environment that exerts a pressure for natural selection,
 - explains the role that variation in individual characteristics plays in the evolution of resistant populations,
 - explains how new generations of offspring play a role in the evolution of resistant bacterial populations, and
 - uses specific examples and evidence to support your response.
2. Describe in two or three sentences the interaction between culture and medicine.

Further Challenges

1. Explain how the difference in generation time for humans (about 20 years) or bacteria (about 20 minutes) makes a difference in their rates of evolutionary change.

Strategies for Guiding Learners

Process and Procedures

Step 1

You can assign this activity as homework or as a take-home examination to help assess the student's understanding of evolution.



Step 2

As the students write their responses to explain why the outcome for the patient was different in each time period, look for evidence that they understand the advent of the use of antibiotics. Penicillin and other antibiotics were not available in 1925 (penicillin was discovered in the late 1920s and was available for common use in the 1940s), so doctors had no effective way to treat a staph infection at that time. In the 1945 scenario the patient has the same infection but is treated with penicillin, which kills the bacteria. By 1965 penicillin had been used so often that some resistant bacteria strains had evolved. Although the classic treatment is administered, the patient does not survive because the bacteria are different and do not respond to penicillin.

Analysis

1. The example of a bacterial infection in this activity can serve as a model of evolution. In a short essay, explain how this example illustrates evolution in action in modern times. A good description of this model of evolution:

- describes the evolutionary change that occurs in this model,
- identifies the factor in the bacteria's environment that exerts a pressure for natural selection,
- explains the role that variation in individual characteristics plays in the evolution of resistant populations,
- explains how new generations of offspring play a role in the evolution of resistant bacterial populations, and
- uses specific examples and evidence to support your response.

Key ideas that students should include in their essays include the following:

- Bacteria that originally were killed by penicillin have evolved to have an adaptation that allows them to survive in the presence of the antibiotic.
- Bacteria reproduce quickly so they can create many generations in a single day, which increases the opportunity for mutations (changes) in a relatively short time. Eventually the variation that favored survival (and subsequent reproduction) became predominant.
- Rapid succession of populations increases the possibility of a variation of bacteria that will be resistant to an antibiotic.

2. Describe in two or three sentences the interaction between culture and medicine.

In Western cultures, generally people think that doctors have all sorts of medical cures at their fingertips. Many people would rather take a pill than think about how to modify their lifestyle to produce the needed results. Students should comment on the relationship between attitudes and medicine in a culture they know.